PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (**http://bmjopen.bmj.com/site/about/resources/checklist.pdf**) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Disease and Age Pattern of Hospitalization and Associated Costs in India: 1995-2014
AUTHORS	Kastor, Anshul; Mohanty, Sanjay

VERSION 1 – REVIEW

REVIEWER	Jørgen T. Lauridsen niversity of Southern Denmark, Denmark
REVIEW RETURNED	25-Apr-2017

GENERAL COMMENTS	The contribution of the study is motivated, significant and well described. Literature is appropriately reviewed and up to date. Methodology is satisfactory. As you also do, one can discuss the quality and sufficiency of the data, but I know the state of this for the case of India, and you get the best out of it. I have no reservation in recommending publication.

REVIEWER	Richard McNally Newcastle University, UK
REVIEW RETURNED	21-Jun-2017

GENERAL COMMENTS	In general there is a lack of clarity and detail. The objectives are design are not clearly stated. The methods are not fully described. Statistics are not described and are not used throughout the analyses (for example, means are used in tables, but data have not been checked for normality). The logistic regression is not described and integrated into the narrative. There are numerous shortcomings, which I don't think are easily fixable.

REVIEWER	Neeraj Sood University of Southern California USA
REVIEW RETURNED	07-Jul-2017

GENERAL COMMENTS	This is a descriptive analysis which documents: 1. Increase in the rate of hospitalization in India 2. Faster increase in the rate of hospitalization for NCD 3. Increase in the out of pocket costs of hospitalization Overall these findings are significant and interesting.

	I think the paper can improved as follows. 1. The abstract can be made clearer. (a) There are several grammatical errors. For example, "the working age adults" should be "working age adults". Similarly, "increase in hospitalization has doubled" should be "hospitalization rate has doubled" (b) The abstract and manuscript should be clear that the "costs" measured in this paper are out of pocket costs borne by the patient. (c) The abstract should make clear that the costs are measured in real 2014 rupees. (d) The conclusion in the abstract does not follow from the analysis and needs to be rewritten to highlight the main results from the analysis. 2. The manuscript could be improved by: (a)Having a copy editor review the manuscript for grammatical errors and flow. Some of the sentences did not make sense to me. For example, on page 3 line 9 "while health care is largely inelastic in nature". (b) It would helps the international reader if the costs could be converted to USD for at least some tables or key results. (c) The authors should make clear that the costs are calculated conditional on hospitalization. That is, they do not take into account the increasing prevalence of hospitalization. (d) Additional analysis should be done to estimate unconditional costs. This is a key outcome as it shows the expected hospitalization costs per 100,000 persons. It captures the increase in burden due to both increase in prevalence and increase in costs conditional on hospitalization. A decomposition which attributes the increase in unconditional costs to these two factors would be very useful. (e) I don't understand why CBR at the state level was used as a covariate? The authors should use state level policies related to health care access as covariates or just drop the analysis. (f) The discussion should include discuss the increase in social health insurance during this time and despite that the increase in out of pocket burden. What was the take up of RSBY, what about other state insurance programs etc.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
Jørgen T. Lauridsen
University of Southern Denmark, Denmark
Please state any competing interests or state ‘None declared’: None declared

Please leave your comments for the authors below

Comment: The contribution of the study is motivated, significant and well described. Literature is appropriately reviewed and up to date. Methodology is satisfactory. As you also do, one can discuss the quality and sufficiency of the data, but I know the state of this for the case of India, and you get the best out of it. I have no reservation in recommending publication.

Response: Thank you so much Prof. Lauridsen for appreciating the manuscript and recommending it for publication.

Reviewer: 2
Richard McNally
Newcastle University, UK
Please state any competing interests or state ‘None declared’: None declared

Please leave your comments for the authors below

Comment: In general there is a lack of clarity and detail. The objectives are design are not clearly stated. The methods are not fully described. Statistics are not described and are not used throughout the analyses (for example, means are used in tables, but data have not been checked for normality). The logistic regression is not described and integrated into the narrative. There are numerous shortcomings, which I don't think are easily fixable.

Response: Thank you so much Dr. Richard McNally for your comments and suggestions. We have incorporated your comments and suggestions which have really enhanced the quality of this manuscript. The objectives have been explicitly stated. We have also described the methods that we used in the analysis. We have also given the equation and description of the logistic regression used in the analysis.

Reviewer: 3
Neeraj Sood
University of Southern California, USA
Please state any competing interests or state ‘None declared’: None declared

Please leave your comments for the authors below

Response: Thank you so much Prof. Neeraj Sood for your valuables suggestions and comments. We have tried to incorporate all of your suggestions and comments which have been really helpful in strengthening the quality and structure of this manuscript.

This is a descriptive analysis which documents:
1. Increase in the rate of hospitalization in India
2. Faster increase in the rate of hospitalization for NCD
3. Increase in the out of pocket costs of hospitalization
Overall these findings are significant and interesting.

I think the paper can improved as follows.
1. The abstract can be made clearer.
(a) There are several grammatical errors. For example, "the working age adults" should be "working age adults". Similarly, "increase in hospitalization has doubled" should be "hospitalization rate has doubled"

Response: We have modified the sentence accordingly. We have also done the copy editing of this manuscript from English professional.

(b) The abstract and manuscript should be clear that the "costs" measured in this paper are out of pocket costs borne by the patient.

Response: We have added the point stating that the costs used in the paper are out-of-pocket expenditure.

(c) The abstract should make clear that the costs are measured in real 2014 rupees.

Response: Done

(d) The conclusion in the abstract does not follow from the analysis and needs to be rewritten to highlight the main results from the analysis.

Response: We have rewritten the conclusion based on the findings of this paper.

2. The manuscript could be improved by:
(a)Having a copy editor review the manuscript for grammatical errors and flow. Some of the sentences did not make sense to me. For example, on page 3 line 9 "while health care is largely inelastic in nature".
As mentioned, we have done the copy editing of this manuscript by English professional for grammatical errors and flow. Corrections are also made as suggested by the reviewer.
(b) It would helps the international reader if the costs could be converted to USD for at least some tables or key results.

Response: We have converted all the costs in US Dollars.

(c) The authors should make clear that the costs are calculated conditional on hospitalization. That is, they do not take into account the increasing prevalence of hospitalization.

Response: Done

(d) Additional analysis should be done to estimate unconditional costs. This is a key outcome as it shows the expected hospitalization costs per 100,000 persons. It captures the increase in burden due to both increase in prevalence and increase in costs conditional on hospitalization. A decomposition which attributes the increase in unconditional costs to these two factors would be very useful.

Response: We have estimated the unconditional cost and also applied the decomposition analysis. Hope this must be the same as suggested by the reviewer.

(e) I don't understand why CBR at the state level was used as a covariate? The authors should use state level policies related to health care access as covariates or just drop the analysis.

Response: We have dropped the state level CBR from the analysis.

(f) The discussion should include discuss the increase in social health insurance during this time and despite that the increase in out of pocket burden. What was the take up of RSBY, what about other state insurance programs etc.
Response: We have modified the discussion section as suggested by reviewer.

VERSION 2 – REVIEW

REVIEWER	Neeraj Sood University of Southern California
REVIEW RETURNED	17-Aug-2017

GENERAL COMMENTS	Thank you for the revisions. Overall the paper is much improved. However, I do have some minor concerns: 1. I noticed a few grammatical issues with the paper. For example, the abstract uses the word "the" excessively and incorrectly. Please have a copy editor review the paper again. 2. Should nt the unconditional hospital costs be simply conditional hospital costs (what you refer in the paper as mean cost of hospitalization or per capita real cost of hospitalization) times the hospitalization rate. However, when I do the calculation the numbers do not match. To be more specific: Unconditional costs = total hospital costs/population at risk Mean hospital costs = total hospital costs/number of hospitalization hospitalization rate = number of hospitalization/population at risk Given above formula unconditional costs = mean hospital costs x hospitalization rate. Please correct your numbers or explain why they don't match. 3. The decomposition I was looking for uses the above formula: Unconditional Costs [t] = Mean[t]xHospitalRate[t] Unconditional Costs [t+1] = Mean[t+1t]xHospitalRate[t+1] Unconditional Costs [t+1] - Unconditional Costs [t] = (Mean[t+1) - Mean[t))xHospitalRate(t+1) + (HospitalRate[t+1]-HospitalRate[t])xM(t) The first term in the decomposition above is the changes in costs due to hospital costs and the second term is change in costs due to hospitalization rate. The changes in hospitalization rate might in turn be due to aging population or other factors but that is a separate issue. 4. Please use terms carefully and consistently. I would use the following: a. Cost per hospitalization = Total costs/number of hospitalizations b. hospitalization rate - this is used consistently in the paper c. unconditional hospital costs per capita or per 100,000 = a times b

VERSION 2 – AUTHOR RESPONSE

We sincerely thank the reviewer for his valuable suggestions and comments in enhancing the quality of the paper. We have tried to incorporate and respond all the suggestions and queries raised by the reviewer.

1. I noticed a few grammatical issues with the paper. For example, the abstract uses the word "the" excessively and incorrectly. Please have a copy editor review the paper again.

Response: We have copy edited the paper again.

2. Should not the unconditional hospital costs be simply conditional hospital costs (what you refer in the paper as mean cost of hospitalization or per capita real cost of hospitalization) times the hospitalization rate. However, when I do the calculation the numbers do not match. To be more specific:
Unconditional costs = total hospital costs/population at risk
Mean hospital costs = total hospital costs/number of hospitalization
hospitalization rate = number of hospitalization/population at risk
Given above formula unconditional costs = mean hospital costs x hospitalization rate.
Please correct your numbers or explain why they don't match.

3. The decomposition I was looking for uses the above formula:
Unconditional Costs [t] = Mean[t]xHospitalRate[t]
Unconditional Costs [t+1] = Mean[t+1t]xHospitalRate[t+1]
Unconditional Costs [t+1] - Unconditional Costs [t] = (Mean[t+1) - Mean[t))xHospitalRate(t+1) + (HospitalRate[t+1]-HospitalRate[t])xM(t)
The first term in the decomposition above is the changes in costs due to hospital costs and the second term is change in costs due to hospitalization rate.
The changes in hospitalization rate might in turn be due to aging population or other factors but that is a separate issue.

Response: The numbers don’t match basically because of the weights applied for calculating hospitalization rates. We have used the “iweight” in the data sets (to get the total population size of India for numerator and denominator). So, for 1995, we got “14017749” hospitalization cases as numerator and “843815624” population at risk as denominator (our estimates matched with the NSS report by following the same procedure). The respective figures for 2014 were “41600815” and “1124598513”. Accordingly, the hospitalization rates were estimated as 0.01661 (or 1661 per 100000 population) in 1995 and 0.03699 (or 3699 per 100000 population) in 2014. If we would have calculated the hospitalization rates based on NSS samples (without applying any weights) then it would be around 0.04188 (or 4188 per 100000 population) for 1995 and 0.12716 (or 12716 per 100000 population) for 2014 which is about three times higher than the actual hospitalization rates for both points of time.
Nonetheless, as suggested by reviewer, we have recalculated the unconditional and conditional costs per hospitalization and hospitalization rates for both the time periods. The details of the variables used and results are presented in Table 1 and Table 2. The decomposition results exactly matched as shown in Table 2; the difference in unconditional cost per hospitalization was Rs.2014. The total changes in unconditional due to increase in cost per hospitalization was Rs.1009 (50.1%) and due to change in hospitalization rates was Rs.1005 (49.9%). These estimates are unweighted.

Table 1: Unconditional and conditional costs per hospitalization and hospitalization rates
Indicators 1995 2014

Total Hospital Costs (US$) 5144898 13848246
No. of Hospitalization 26526 42662
Population at risk 633408 335499
Mean Unconditional Costs 8 41
Mean Hospital Costs 193.96 324.60
Hospitalization Rate 0.04188 0.12716

Table 2: Decomposition results

	Change in unconditional cost due to change in	
Total Change (US$)	Mean Costs	Hospitalization Rates
33.15	(324.60-193.96*0.12716) = 16.61	(0.12716-0.04188*193.96) =16.54
Percentage Share	50.1	49.9

It is also to be mentioned that the costs per hospitalization given in Table 1 (US$ 194 in 1995 and US$ 325 in 2014) is slightly different from what is given in the manuscript (US$ 177 in 1995 and US$ 316 in 2014). This is again because of applying analytical weights.
Now, as per the reviewer's suggestion, we have replaced the above results with the earlier one in the result section "Decomposition of change in unconditional costs of hospitalization" mentioning the point that these estimates are unweighted.
4. Please use terms carefully and consistently. I would use the following:
a. Cost per hospitalization = Total costs/number of hospitalizations
b. hospitalization rate - this is used consistently in the paper
c. unconditional hospital costs per capita or per 100,000 = a times b
Response: We have made the changes accordingly in the revised manuscript.

VERSION 3 – REVIEW

REVIEWER	Neeraj Sood Sol Price School of Public Policy University of Southern California USA
REVIEW RETURNED	11-Oct-2017

GENERAL COMMENTS	Please present weighted results for the decomposition. So present weighted hospitalization rate, weighted unconditional costs, and weighted conditional costs. Then use these statistics to do the decomposition. In the manuscript please clearly note when you present weighted versus unweighted statistics. Weighted statistics should be the main results as they are representative of India. Other changes were fine.

VERSION 3 – AUTHOR RESPONSE

We sincerely thank the reviewer for his valuable suggestions and comments in enhancing the quality of the paper. We have incorporated all the suggestions given by the reviewer.

Reviewer's Comments: Please present weighted results for the decomposition. So present weighted hospitalization rate, weighted unconditional costs, and weighted conditional costs. Then use these statistics to do the decomposition. In the manuscript please clearly note when you present weighted versus unweighted statistics. Weighted statistics should be the main results as they are representative of India.

Response: Thank you so much for your suggestion. As per your suggestion, we have presented the weighted estimates of decomposition results in the revised manuscript (we used weighted hospitalization rate, weighted unconditional costs, and weighted conditional costs- presented in the table given below). All results presented in the manuscript are also weighted.

Table: Indicators used for decomposing the change in unconditional costs per hospitalization in India during 1995-2014 (all are weighted results).

Indicators	1995	2014
Mean Unconditional Costs	2.9	11.6
Mean Hospital Costs	177	316
Hospitalization Rate	0.01661	0.03699

VERSION 4 – REVIEW

REVIEWER	Neeraj Sood Sol Price School of Public Policy, University of Southern California
REVIEW RETURNED	31-Oct-2017

GENERAL COMMENTS	No further changes